THAT WHICH IS CLAIMED:

1. A substrate having a chemically modified surface, said substrate comprising a base layer having a coating positioned thereon, the coating comprising a chemically crosslinked material comprising elements selected from the group consisting of (1) M, O, C, H, and N; wherein M is a metal selected from the group consisting of silicon, titanium, tantalum, germanium, boron, zirconium, aluminum, hafnium and yttrium; (2) M, O, H, and N wherein M is defined above, (3) C; (4) O, C, H, and N; and (5) M or C, and one of O, H, or N, wherein the chemically crosslinked material is terminated with at least one electrophilic or nucleophilic functional group.

2. The substrate according to Claim 1, wherein M is silicon.

3. The substrate according to Claim 2, wherein the chemically crosslinked composition comprises from about 30 to about 60 percent carbon and from about 10 to about 40 percent silicon.

4. The substrate according to Claim 1, wherein the surface of the coating is terminated with at least one electrophilic functional group.

5. The substrate according to Claim 4, wherein the at least one electrophilic functional group comprises one or more elements selected from the group consisting of carbon, hydrogen, nitrogen and silicon.

6. The substrate according to Claim 5, wherein at least one biomolecule is adsorbed to the at least one electrophilic functional group.

7. The substrate according to Claim 6, wherein the at least one biomolecule is selected from the group consisting of DNA, nucleic acids, proteins, enzymes, cells, viruses, and combinations thereof.

8. The substrate according to Claim 1, wherein the surface of the coating is terminated with at least one nucleophilic functional group.

9. The substrate according to Claim 8, wherein the at least one nucleophilic functional group comprises one or more elements selected from the group consisting of carbon, silicon, halogens, oxygen, hydrogen, nitrogen, sulfur, and phosphorus.

10. The substrate according to Claim 8, wherein the surface of the coating is non-adsorbing with respect to biomolecules.

11. A substrate according to Claim 1, wherein at least one portion of the surface of the coating is terminated with at least one electrophilic functional group and at least one other portion of the surface of the coating is terminated with at least one nucleophilic functional group.

12. The substrate according to Claim 11, wherein the at least one portion of the surface of the coating terminated with at least one electrophilic functional group and at least one other portion of the surface of the coating terminated with at least one nucleophilic functional group are adjacent to one another.

13. The substrate according to Claim 11, wherein the at least one nucleophilic functional group comprises one or more elements selected from the group consisting of carbon, silicon, halogens, oxygen, hydrogen, nitrogen, sulfur, and phosphorus.

14. The substrate according to Claim 11, wherein the at least one electrophilic functional group comprises one or more elements selected from the group consisting of carbon, nitrogen, hydrogen, and silicon.

15. The substrate according to Claim 11, wherein at least one biomolecule is adsorbed to the at least one electrophilic functional group.

16. The substrate according to Claim 15, wherein the at least one biomolecule is selected from the group consisting of nucleic acids, proteins, enzymes, cells, viruses, and combinations thereof.

17. The substrate according to Claim 1, wherein the coating is at least a fraction of a monolayer thick.

18. The substrate according to Claim 1, wherein the base layer comprises a material selected from the group consisting of glass, plastics, elastomers, metals, and ceramics.

19. The substrate according to Claim 1, further comprising an intermediate layer positioned between said base layer and said coating.

20. The substrate according to Claim 19, wherein the intermediate layer comprises at least one material selected from the group consisting of indium tin oxide (ITO), tin oxide, titanium oxide, manganese oxide, lead oxide, gold, platinum, palladium, carbon, , silicon, germanium, zinc oxide, cadmium sulfide, titanium dioxide, gallium arsenide, combinations thereof, and alloys thereof.

21. A detection system comprising the substrate according to Claim 1.

22. The detection system according to Claim 21, wherein the detection system is selected from the group consisting of an electrochemical detection system, a chemical detection system, and an optical detection system.

23. The detection system according to Claim 21, wherein the surface of the coating is terminated with at least one electrophilic group.

24. The detection system according to Claim 23, wherein the at least one electrophilic group consists of one or more elements selected from the group consisting of carbon, nitrogen, hydrogen, and silicon.

25. The detection system according to Claim 23, wherein at least one biomolecule is adsorbed to the at least one electrophilic group.

26. The detection system according to Claim 25, wherein the at least one biomolecule is selected from the group consisting of nucleic acids, proteins, enzymes, cells, viruses, and combinations thereof.

27. The detection system according to Claim 21, wherein the surface of the coating is terminated with at least one nucleophilic group.

28. The detection system according to Claim 27, wherein the at least one nucleophilic group comprises one or more elements selected from the group consisting of carbon, silicon, halogens, oxygen, hydrogen, nitrogen, sulfur, and phosphorus.

29. The detection system according to Claim 21, wherein the surface of the coating is non-adsorbing with respect to biomolecules.

30. The detection system according to Claim 29, wherein the biomolecules are selected from the group consisting of nucleic acids, proteins, enzymes, cells, viruses, and combinations thereof.

31. A microfluidic system comprising the substrate according to Claim 1.

32. The microfluidic system according to Claim 32, wherein the system comprises at least one biofouling surface.

33. A method of chemically modifying a surface on a substrate, said method comprising:

exposing a composition comprising at least one precursor to an energy source to form a energized precursor;

promoting the energized precursor into an excited state to produce ionic materials;

depositing the ionic materials on a base layer such that the ionic materials form a coating thereon, the coating comprising a chemically crosslinked material comprising elements selected from the group consisting of (1) M, O, C, H, and N; wherein M is a metal selected from the group consisting of silicon, titanium, tantalum, germanium, boron, zirconium, aluminum, hafnium and yttrium; (2) M, O, H, and N wherein M is defined above, (3) C; (4) O, C, H, and N; and (5) M or C, and one of O, H, or N; and

treating the chemically crosslinked material such that the material is terminated with at least one electrophilic or nucleophilic functional group.

34. The method according to Claim 33, wherein the precursor is selected from the group consisting of silanes, siloxanes, silazanes, hydrocarbons, metal organics, titanates, metal alkoxides, and combinations of the above.

35. The method according to Claim 33, wherein the precursor is selected from the group consisting of tetrametylsilane, trimetylsilane, tetramethoxysilane, hexamethyl disilane, hexamethyl disiloxane, hexamethyl disilazane, methane, ethane, ethylene, tetraalkoxy titanates, and combinations thereof.

36. The method according to Claim 33, wherein the energy source is selected from the group consisting of direct current, radio frequency, microwave, enhanced plasma, and a hollow cathode magnetron source.

37. The method according to Claim 33, wherein said method is a Chemical Vapor Deposition (CVD).

38. The method according to Claim 33, wherein said method is a Plasma Enhanced Chemical Vapor Deposition (PECVD).

39. The method according to Claim 33, wherein the ionic materials comprise ionic fragments, free radicals, atoms, molecules, and mixtures thereof.

40. The method according to Claim 33, wherein said treating step comprises treating the chemically crosslinked material such that the material is terminated with at least one electrophilic functional group

41. The method according to Claim 40, wherein said treating step comprises a plasma treatment.

42. The method according to Claim 33, wherein said treating step comprises treating the chemically crosslinked material such that the material is terminated with at least one nucleophilic functional group.

43. The method according to Claim 42, wherein said treating step comprises a plasma treatment.